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ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

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DOCKETED
MAY 20 2019
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AZ CORP COMMISSION
DOCKET CONTROL
2019 MAY 20 P 2: 44

May 20, 2019

To: Arizona Corporation Commission
Docket RU-00000A-18-0284

RE: Possible Modifications to ACC's Energy Rules

Dear Commissioners:

The Arizona Department of Environmental Quality (ADEQ) is pleased to submit comments on the possible modifications to the Arizona Corporation Commission's Energy Rules. ADEQ will first provide background on the health impacts and regulatory costs of ozone because the primary focus of these comments is the impact of energy policy on ozone pollution. We will then address the potential benefits of specific policy areas that the Commission is considering. In order to provide meaningful and quantified analysis, ADEQ sourced numeric goals from Docket RU-00000A-18-0284 as the basis for evaluation.

BACKGROUND INFORMATION ON OZONE POLLUTION

EFFECTS OF OZONE

Ozone is a gas composed of three atoms of oxygen that occurs in both in the stratosphere[1] and the ground-level atmosphere.[2] In the stratosphere, the ozone layer provides crucial protection from the sun's ultra-violet radiation; however, at ground level, ozone is an air pollutant that endangers public health and welfare.

Some of the health effects of ozone that have been observed include:

- Induction of respiratory symptoms, including coughing, throat irritation, pain, burning, or discomfort in the chest when taking a deep breath, chest tightening, wheezing, or shortness of breath due to the constriction of the muscles in the airways and trapping air in the alveoli;
- Decrements in lung function; and
- Inflammation of airways and increased risk of respiratory infections.

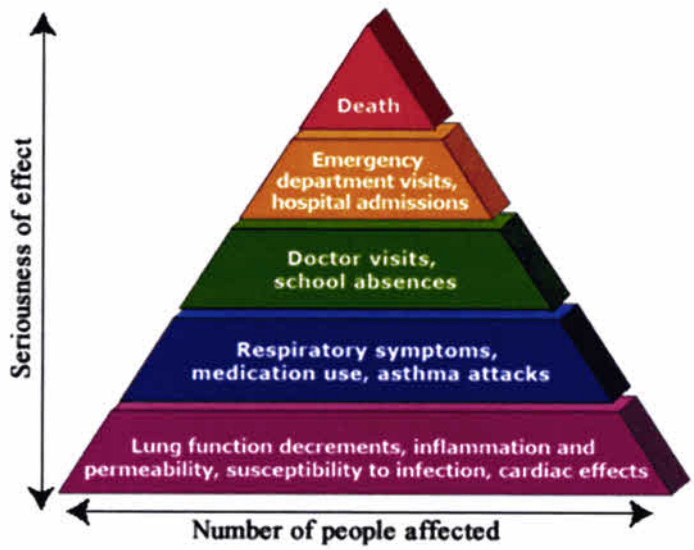
[1] The atmospheric layer that starts 5 to 11 miles above the earth's surface and extends to 31 miles above the surface.

[2] The atmospheric layer that starts at the earth's surface and extends to the bottom of the stratosphere.

In addition to these effects, higher daily ozone concentrations are associated with increased asthma attacks and worsened chronic obstructive pulmonary disease (COPD), early death (both from short-term and long-term exposure), harm to the central nervous system, and reproductive and developmental harm.[3] Studies have also reported positive relationships between short-term ozone concentrations and hospital admissions and emergency room visits for respiratory causes, like asthma or COPD.[4]

Figure 1 provides a summary of the health effects of ozone pollution organized by seriousness and frequency (source: www.epa.gov):

Figure 1 Ozone Effect Pyramid



OZONE SOURCES

Ground-level ozone is not emitted directly but forms from the reaction of two precursors—volatile organic compounds (VOC) and oxides of nitrogen (NO_x)—in the presence of sunlight. Both natural and anthropogenic sources of these precursors contribute to ozone formation. Natural and anthropogenic combustion sources, such as, motor vehicle engines, boilers, combustion turbines, and wild fires, are responsible for virtually all emissions of NO_x. Motor vehicles, the use of solvents, and vegetation are among the primary sources of VOC.

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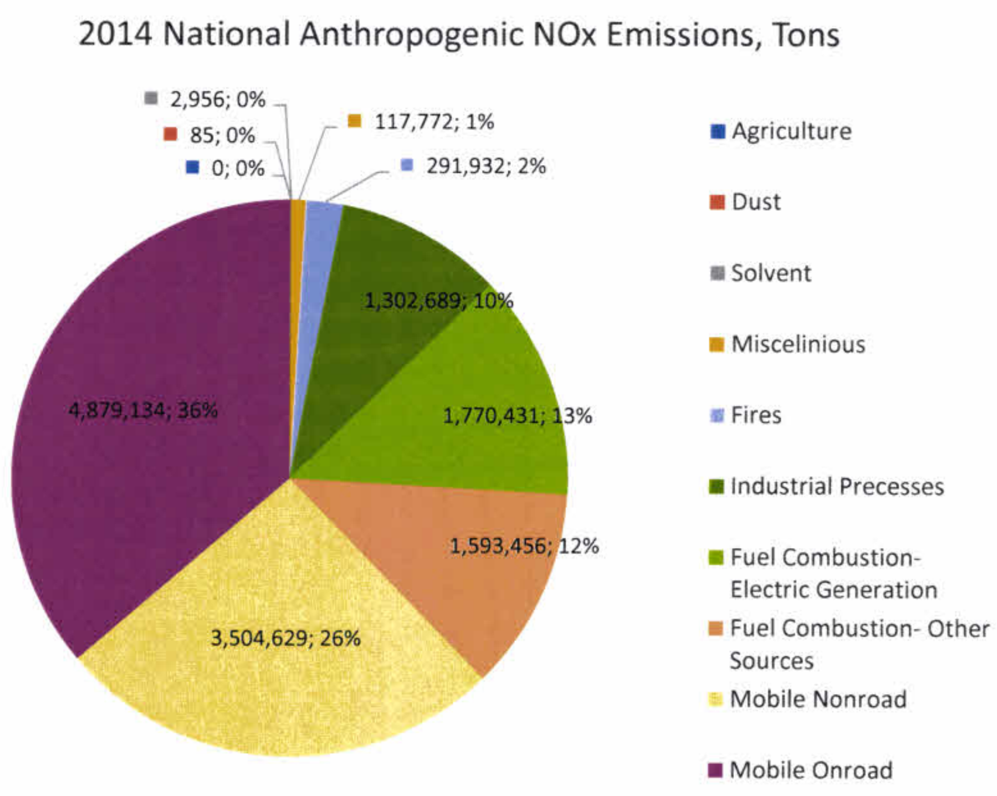
[3] U.S. Environmental Protection Agency, Integrated Science Assessment for Ozone and Related Photochemical Oxidants, 2013. EPA/600/R-10/076F.

[4] Gent JF, Triche EW, Holford TR, Belanger K, Bracken MB, Beckett WS, Leaderer BP. Association of Low-Level Ozone and Fine Particles with Respiratory Symptoms in Children with Asthma. *JAMA*.2003; 290:1859-1867; Desqueyroux H, Pujet JC, Prosper M, Squinazi F, Momas I. Short-Term Effects of Low-Level Air Pollution on Respiratory Health of Adults Suffering from Moderate to Severe Asthma. *Environ Res.* 2002; 89:29-37; Burnett RT, Brook JR, Yung WT, Dales RE, Krewski D. Association between Ozone and Hospitalization for Respiratory Diseases in 16 Canadian Cities. *Environ Res.* 1997; 72:24-31; *Medina-Ramón M, Zanobetti A, Schwartz J. The Effect of Ozone and PM10 on Hospital Admissions for Pneumonia and Chronic Obstructive Pulmonary Disease: a national multicity study. Am J Epidemiol. 2006;* 163(6):579-588.

The policies outlined in the Arizona Energy Modernization Plan (AEMP) would primarily affect NO_x emissions, which are therefore the focus of ADEQ's comments relating to ozone. It should be noted that in addition to ozone pollution, reductions in NO_x emissions would contribute to other air quality goals, such as reducing visibility impairment and concentrations of particulate matter.

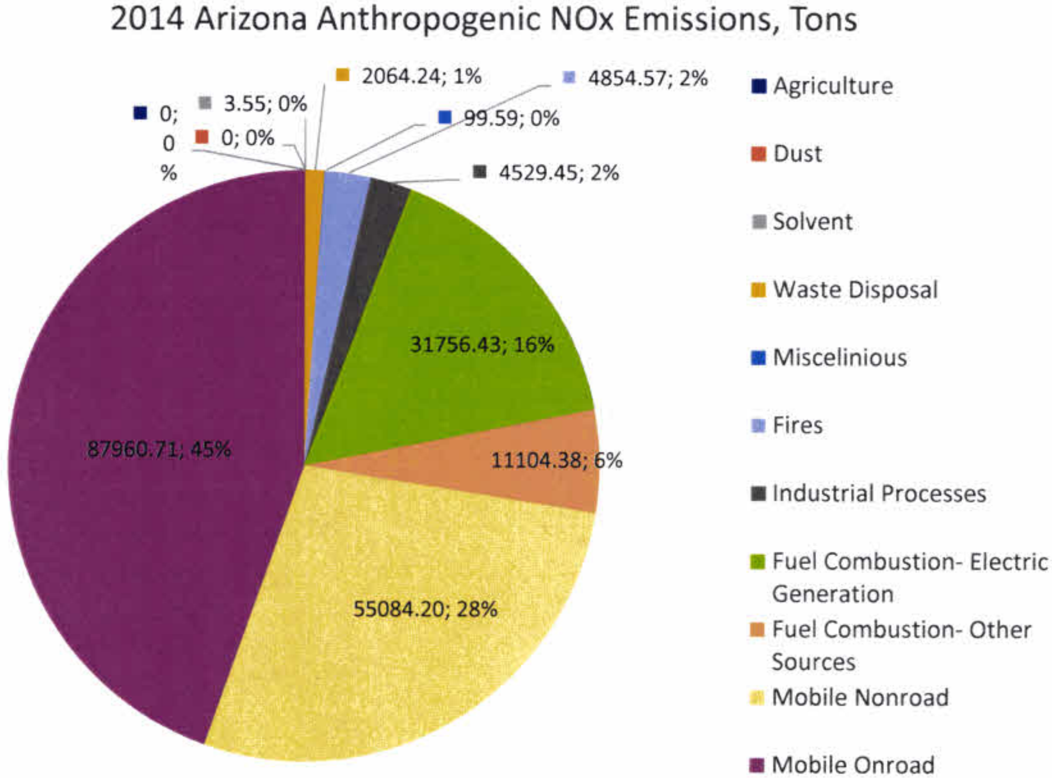
As shown in Figure 2 and Figure 3, the three largest sources of NOx both nationally and in Arizona are on-road (e.g. automobiles) and off-road mobile sources (e.g., construction and agricultural equipment), and electric generating units (EGUs).[5]

Figure 2 National Sources of NO_x in Tons



[5] Source: National Emissions Inventory for 2014

Figure 3 Arizona Sources of NOx



NATIONAL REGULATION OF OZONE

Under the federal Clean Air Act, the U.S. Environmental Protection Agency (EPA) is responsible for national health standards for air pollution, known as national ambient air quality standards (NAAQS), and the states are responsible for developing "State Implementation Plans" (SIPs) designed to achieve the NAAQS in the areas subject to their jurisdiction.[6]

As shown in Table 1, EPA first adopted a NAAQS for ozone in 1979 and has revised it three times, each time making the standard more stringent to reflect the latest scientific evidence on health effects.

[6] 42 U.S.C. §§ 7408(a)(1), 7409(a), 7410(a).

Table 1 Ozone NAAQS Over Time

Year	Standard
1979	**120 parts per billion (ppb) 1-hour average**
1997	80 ppb 8-hour average
2008	**75 ppb 8-hour average**
2015	70 ppb 8-hour average

As amended in 1990, the Clean Air Act establishes specific requirements for areas of the country that are "nonattainment" for (i.e. violate) a NAAQS. In nonattainment areas, the SIP must require a new major source of the pollutant (or its precursors) for which the area is nonattainment to:

- install controls reflecting the "lowest achievable emission rate" (LAER) and
- secure reductions in emissions from other sources in the nonattainment area that at a minimum completely offset the emissions increase from the new source.

These requirements also apply to changes at a major source that increase emissions by an amount specified by rule. Such changes are referred to as "major modifications."

In addition to the requirements for new sources, SIPs for nonattainment areas must provide for the installation of reasonably available control technology (RACT) on existing sources and must impose other controls sufficient to result in attainment of the NAAQS by the deadline specified in the Clean Air Act.[7]

The Clean Air Act establishes a system for classifying ozone nonattainment areas according to the seriousness of the NAAQS violation. Under this system, areas with higher classifications are subject to more stringent control requirements in exchange for being given longer to attain the ozone NAAQS. Areas that fail to attain the NAAQS by the deadline specified for their classification are "bumped up" to the next higher classification.[8] The requirements for the first three classifications are summarized in *Table 2*.

[7] 42 U.S.C. §§ 7502, 7503.
[8] 42 U.S.C. §§ 7511-7511f.

Table 2 Ozone Nonattainment Area Requirements by Classification

Classification	Major Source Threshold [9]	Major Modification Threshold	Offset Ratio[10]	Impact to Existing Sources	State Programs Required
Marginal	100	40	1.10:1	None	None
Moderate	100	40	1.15:1	RACT on all major sources	Area-wide 15 % emission reduction over 6 years; Basic vehicle emissions inspection (VEI) program
Serious	50	25	1.20:1	RACT on additional source categories	Annual 3 % emission reduction until attainment; Enhanced VEI; enhanced monitoring

IMPACT OF OZONE REGULATION ON ARIZONA

The Phoenix area, including parts of Gila and Pinal Counties, is currently a nonattainment area for the 2015 national ambient air quality standards (NAAQS) for ozone of 70 parts per billion (ppb). Based on 2018 monitoring data, Phoenix ozone concentration has been steadily increasing since 2016.

If EPA determines that Phoenix did not attain the 2008 ozone NAAQS in 2017, the area will be reclassified from moderate to serious and will become subject to the requirements in the last row in Table *2*.[11] Among other things, the number of major sources potentially subject to the LAER and offset requirements will increase from 25 to 40 and the level of offsets required for emissions increases from these sources will go up.

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[9] All thresholds are in tons per year (TPY) of emissions of a particular ozone precursor projected to result from a new major source or major modification.

[10] An increase in emissions from a new major source or major modification must be offset by decreases equal to the increase multiplied by this ratio. So a new source with emissions of 100 tons per year could only obtain a permit to construct and operate in a moderate nonattainment area if it secured emissions decreases of 115 TPY.

[11] In order to prevent backsliding, the requirements for a NAAQS generally remain in effect, even after a new more stringent NAAQS is adopted.

If EPA approves two exceptional events, Phoenix may be found to be in attainment for the 2008 standard but all existing requirements and controls will continue under anti-backsliding rules. In addition, both the Phoenix area and Yuma have been designated nonattainment for the more stringent 2015 NAAQS of 70 ppb. Both areas are likely to be classified as marginal initially, but would be bumped up to higher classifications if they failed to meet their attainment deadlines. If the 2015 NAAQS is not attained by 2024, both Phoenix and Yuma areas may be facing a "serious" designation again.

Numerous other areas of the state are close to nonattainment and will be in danger of being designated nonattainment in the future if concentrations increase. Concentrations may increase as a result of meteorology, even if emissions do not. Thus, decreases in emissions of ozone precursors would help protect these areas from the consequences of nonattainment.

ADEQ has estimated the annual cost to the Phoenix metropolitan area of being designated nonattainment as follows: [12]

Table 3 Nonattainment Costs

Cost Categories	Low Annual Estimate	High Annual Estimate
Transportation Conformity – Analysis Cost	$82,143	$250,000
Transportation Conformity – Routine Construction Project Delays	$2,177,430	$3,294,782
Transportation Conformity – Lapse Construction Project Delays	$1,453,793	$7,389,628
Transportation Conformity – Loss of Federal Funds	$1,886,618	$5,930,441
General Conformity – Aviation Delays	$1,783,525	$3,567,050
NO_x Point Source Emission Reductions	$10,106,752	$146,271,468
VOC Emission Reductions	$89,954,254	$129,515,967
Total	**$89,383,633**	**$296,219,337**

[12] These costs were estimated based on a report ("The Potential Cost of an Ozone Nonattainment Designation to Central Texas") funded by the Texas Commission on Environmental Quality (TCEQ), and prepared by the Capital Area Council of Governments Air Quality Program (CAPCOG). See http://www.capcog.org/documents/airquality/reports/2015/Potential_Costs_of_a_Nonattainment_Designation_09-17-15.pdf With the exception of the analysis cost, conformity costs were scaled up from the Austin metro area to the Phoenix metro area based on population. NOx point source emissions reductions were scaled based on the number of major sources (kilns, boilers, turbines, etc.) in Maricopa. VOC emissions reductions were scaled based on population. Costs of Maricopa County specific forfeited industry expansion due to the offset and LAER requirements described above were not included.

Costs for the Yuma nonattainment area or for other areas of the state that may be designated nonattainment for the 2015 ozone NAAQS can be expected to be lower, roughly in proportion to population, but will still be substantial.

POLICY AREA: CLEAN ENERGY GOAL

AIR QUALITY BENEFITS

As shown in Table 4, ADEQ has developed a range of estimates of the reduction in total NOx emissions in Arizona that would result from meeting an 80 % clean energy goal in 2050 measured against a 2014 baseline. As one would expect, the size of the reduction will depend on the composition of the remaining fossil-fuel-fired generation resources:

Table 4 80 % Clean Energy Impact on NOx Emissions

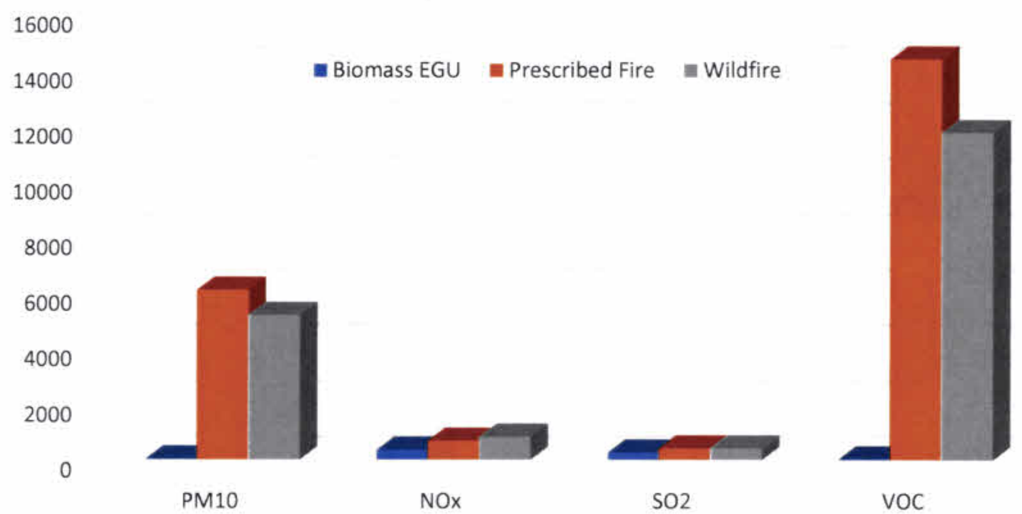
Scenario	2014 Total NO_x (tons)	2050 Total NO_x (tons)	Percent Reduction in NO_x
80 % clean energy, 20 % natural gas (NG)	211,369	181,128	14.3 %
80 % clean energy, 60 MW biomass, 20 % NG	211,369	181,799	14.0 %
80 % reduction across the board	211,369	187,226	11.4 %

Given the current trajectory of coal versus natural gas generation, the first two rows probably present the reductions in NO_x most likely to result from the 80 % clean energy policy. However, any of the forecast reductions would represent a substantial contribution toward assisting Arizona in attaining and maintaining the ozone NAAQS.

POLICY AREA: FOREST HEALTH AND BIOMASS RELATED ENERGY

ADEQ has estimated the emission reductions that would occur if all biomass combusted in a 60 MW EGU were assumed to originate from lands that would otherwise experience wildfires or prescribed burns. ADEQ estimates that to operate a 60 MW biomass EGU at capacity for one year, would require approximately 439,000 tons of wood waste combustion. This would be the equivalent of clearing approximately 46,000 acres of forested land that would otherwise fuel wildfires or approximately 68,000 acres of prescribed fires. Figure 4 provides a comparison of the emissions estimated from annual operation of the 60 MW biomass EGU as compared to 46,000 acres of wildfire and 68,000 acres of prescribed burn emissions.

Figure 4 Annual Emissions from Equivalent Biomass Burning (tons)



POLICY AREA: ELECTRIC VEHICLES

In Maricopa County, specifically in the Phoenix metropolitan area, fossil-fuel vehicles are the largest contributor to ozone. Therefore, leveraging carpooling, telecommute, mass transit, or electric vehicles to decrease the number of commuter-based, single occupancy fossil fuel vehicles to reduce emissions will be critical to attaining the 2015 ozone standard.

Table 5 Percent contributions of anthropogenic emission source sector in the 4 km modeling domain to high ozone at the North Phoenix site

Emissions Source	May	June	July	August	September
Onroad	45.9%	52.8%	51.2%	58.3%	45.2%
Area	32.1%	20.0%	22.4%	11.6%	32.5%
Nonroad	16.8%	22.4%	20.2%	17.1%	16.1%
Point	5.2%	4.8%	6.2%	13.0%	6.2%

In general, electric vehicles (EV) produce fewer emissions that contribute to ozone pollution and climate change than conventional vehicles. Battery electric vehicles (BEV), of course, produce zero tailpipe emissions, while plug-in hybrid electric vehicles (PHEV), due to their superior fuel efficiency, produce lower tailpipe emissions than gasoline or diesel-powered vehicles.[13]

Life cycle emissions, which include all emissions associated with vehicle and fuel production, are also generally lower for BEV and PHEV than for conventional vehicles, particularly in areas such as Arizona with a relatively clean mix of generating resources.[14]

To develop a rough estimate of the air quality improvements that increased EV usage in Arizona could produce, ADEQ reviewed studies conducted on potential ozone reductions from fleet electrification. These are summarized in Table 6.

Table 6 EV Ozone Impact Studies

Area of Study	Reduction in Vehicle Miles Travelled	Average Ozone Reduction (ppb)
Texas – San Antonio, Austin, Dallas/Fort Worth, Houston[15]	42,514,330 (20%)	1.5
Pennsylvania, New Jersey, Maryland[16]	245,000,000 (20%)	5
Austin[17]	2,414,000 (17%)	5.4

A 20 % increase in EV use in Maricopa County is estimated to reduce ozone concentrations from 1 to 5 ppb.

[13] See https://energy.gov/eere/electricvehicles/reducing-pollution-electric-vehicles and sources cited.
[14] *Id.*
[15] Thompson, Tammy, and King, Carey, and Allen, David, and Webber, Michael. *"Air quality impacts of plug-in hybrid electric vehicles in Texas: evaluating three battery charging scenarios"* Environmental Research Letters 6 (2011) 024004 (11pp).
[16] Thompson, Tammy, and Webber, Michael, and Allen, David. *"Air quality impacts of using overnight electricity generation to charge plug-in hybrid electric vehicles for daytime use"* Environmental Research Letters 4 (2009) 014002 (12pp).
[17] Alhajeri, Nawaf, and McDonald-Buller, Elena, and Allen, David. *"Comparisons of air quality impacts of fleet electrification and increased use of biofuels"* Environmental Research Letters 6 (2011) 024011 (11pp).

CLOSING

ADEQ would like to thank the Commission for the opportunity to submit comments. While specific numeric goals were sourced from Docket RU-00000A-18-0284 as the basis for evaluation, ADEQ stands ready to analyze the impacts of any scenario that the Commission may request. If you have any questions, please do not hesitate to call me at 602-771-2203.

Sincerely,

Misael Cabrera, P.E.
Director

cc: Hunter Moore, Policy Advisor to Arizona Governor Ducey for Natural Resources